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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/071,507 | 02/07/2002 | Michael R. Krames | M-9152-1D US | 4097 |

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EXAMINER

SOWARD, IDA M

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 09/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|-----------------|---------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/071,507 | KRAMES ET AL. |
| Examiner | Art Unit | |
| Ida M Soward | 2822 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 12 June 2003.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-22 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-9, 11-15 and 16-22 is/are rejected.

7) Claim(s) 10 and 16 is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. ____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892) 4) Interview Summary (PTO-413) Paper No(s). _____ .
2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) Notice of Informal Patent Application (PTO-152)
3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ . 6) Other: _____ .

DETAILED ACTION

This Office Action is in response to the Applicants; amendment filed June 12, 2003.

Drawings

The objection to the drawings has been withdrawn due to the amendment filed.

Specification

The objection to the abstract of the disclosure has been withdrawn due to the amendment filed.

The objection to the disclosure has been withdrawn due to the amendment filed.

Claim Objections

The objection to claim 16 has been withdrawn due to the amendment filed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 5, 9, 12-15, 19 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 in view of Inoue et al. (US 6,333,522 B1).

Admitted Prior Art Figures 1-2 and 5 teach a light-emitting device comprising: a heterostructure of III-nitride materials comprising an active region; an n-electrode being attached to an n-layer; a p-electrode being attached to a p-layer; a superstrate having a refractive index greater than a refractive index of sapphire, attached to the heterostructure; the p-electrode having an absorption of ~ 25%; a SiC superstrate; a superstrate attached to the heterostructure. In regard to absorption, 25.3% are approximately 25%, which is in the ranges stated in claim 3. However, Admitted Prior Art Figures 1-2 and 5 fail to expressly teach an active region a peak emission wavelength and a portion of the p-electrode interposing portions of the n-electrode; a light emitting device comprising a submount; an n-interconnect connecting the n-electrode to the Si submount; a p-interconnect connecting the p-electrode to the submount; the n- & p-interconnects are selected from the group consisting of elemental metal and metal alloys; a p-conductive interface disposed between the p-interconnect and the p-electrode; and an n-conductive interface disposed between the n-interconnect and the n-electrode, wherein the n- & p-conductive interface comprise wettable metals and the lateral cross sectional area of the interfaces is at least 15% of the p-electrode. It is within the level of ordinary skill to have a peak emission wavelength because by definition the peak emission wavelength is just the spectral line of a light emitter having the greatest power or the wavelength that suffers the lowest loss and the active region

has a wavelength. Inoue et al. teach a portion of the p-electrode 5 interposing portions of the n-electrode 6 & 8 (Figure 13); a light emitting device comprising a submount 2; an n-interconnect 24 connecting the n-electrode 6 to the Si submount col. 25, lines 61-67); a p-interconnect 25 connecting the p-electrode 5 to the submount (Figures 6B and 20, cols. 16 & 26, lines 41-65 & 5-16, respectively); the n- & p-interconnects are selected from the group consisting of elemental metal and metal alloys (col. 16, lines 60-63); a p-conductive interface 73 disposed between the p-interconnect and the p-electrode; and an n-conductive interface 6-bottom disposed between the n-interconnect and the n-electrode, wherein the n- & p-conductive interface comprise wettable metals and the lateral cross sectional area of the interfaces is at least 15% of the p-electrode (Figures 2 & 8B, cols. 12 & 17, lines 31-34 & 53-58, respectively). In regard to the refractive index of sapphire, Admitted Prior Art Figures 1-2 and 5 teach a superstrate having a 1.84 refractive index and Inoue et al. teach a sapphire substrate having a 1.77 refractive index (col. 1, lines 11-15). Therefore, Admitted Prior Art Figures 1-2 and 5 teach a superstrate, having a refractive index greater than the refractive index of sapphire, attached to the heterostructure. Since, Admitted Prior Art Figures 1-2 and 5 and Inoue et al. are both from the same field of endeavor (light emitting devices), the purpose disclosed by Inoue et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 by incorporating the interposing electrodes as taught by Inoue et al. to enable a reduction in the area required by the

electrodes to achieve electrical connection of the light emitting element (col. 2, lines 17-24).

Claims 2 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 9, 12-15, 19 and 21-22 above, and further in view of Krames et al. (US 2001/0000410 A1).

Admitted Prior Art Figures 1-2 and 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 and 5 and Inoue et al. fail to teach a superstrate having an absorption coefficient 3 cm^{-1} at the peak emission wavelength and light being extracted from the active region through the substrate. Krames et al. teach a superstrate 12 having an absorption coefficient of less than 20 cm^{-1} (3 cm^{-1} lies within this range) at the peak emission wavelength (Figure 2, page 2, paragraphs [0023]-[0024]) and light being extracted from the active region through the substrate (Figure 2, page 3, paragraph [0030]). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Krames et al. are both from the same field of endeavor (light emitting devices), the purpose disclosed by Krames et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 and the interposing electrodes as taught by Inoue et al. by incorporating the absorption coefficient as taught by Krames et al. to improve light extraction efficiency (abstract).

Claims 4 and 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 9, 12-15, 19 and 21-22 above, and further in view of Krames et al. (5,779,924).

Admitted Prior Art Figures 1-2 and 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 and 5 and Inoue et al. fail to teach at least one of the layers comprising the heterostructure is textured; at least one surface of the substrate is roughened; and a top surface area of the substrate is larger than a bottom surface area of the substrate. Krames et al. teach at least one of the layers comprising the heterostructure is textured; at least one surface of the substrate ³ is roughened; and a top surface area of the substrate is larger than a bottom surface area of the substrate (Figure 10, col. 8, lines 12-36). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Krames et al. are both from the same field of endeavor (light emitting devices), the purpose disclosed by Krames et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 and the interposing electrodes as taught by Inoue et al. by incorporating the surface texture, roughness & area of Krames et al. to improve light extraction by increasing the transmission of total optical power from the device (abstract).

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Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 9, 12-15, 19 and 21-22 above, and further in view of Furukawa et al. (5,124,779).

Admitted Prior Art Figures 1-2 and 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 and 5 and Inoue et al. fail to teach a SiC substrate having a resistivity greater than 0.5 Ωcm. Furukawa et al. teach a SiC substrate 12a having a resistivity in the range of 0.1 to 1.0 Ωcm, wherein greater than 0.5 Ωcm is within this range (Figure 2, col. 4, lines 49-54). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Furukawa et al. are both from the same field of endeavor (SiC semiconductor devices), the purpose disclosed by Furukawa et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 and the interposing electrodes as taught by Inoue et al. by incorporating the resistivity as taught by Furukawa et al. to provide a silicon carbide semiconductor device with increased device reliability (col. 2, lines 42-66).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 9, 12-15, 19 and 21-22 above, and further in view of Shigihara et al. (5,247,203).

Admitted Prior Art Figures 1-2 & 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 & 5 and Inoue et al. fail to

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teach a submount thickness of less than 250 μm . Shigihara et al. teach a submount thickness of approximately 150 μm , which is less than 250 μm (Figure 14, col. 1, lines 28-52). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Shigihara et al. are from the same field of endeavor (semiconductor devices), the purpose disclosed by Shigihara et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 & 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 & 5 and the interposing electrodes as taught by Inoue et al. by incorporating the submount thickness of Shigihara et al. to avoid the degradation of light emitting characteristics (col. 1, lines 39-44).

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 9, 12-15, 19 and 21-22 above, and further in view of Iranmanesh (5,521,440).

Admitted Prior Art Figures 1-2 & 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 & 5 and Inoue et al. fail to teach a barrier layer disposed between an electrode and a conductive interface. Iranmanesh teaches a barrier layer 12 containing Ti disposed between an electrode 15 and a conductive interface 11 (Figure 1E, col. 3, lines 21-60). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Iranmanesh are from the same field of endeavor (semiconductor devices), the purpose disclosed by Iranmanesh would have been

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recognized in the pertinent art of Admitted Prior Art Figures 1-2 & 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 & 5 and the interposing electrodes as taught by Inoue et al. by incorporating the barrier layer as taught by Iranmanesh to block the undesired inter-diffusion of material (col. 1, lines 27-30).

Allowable Subject Matter

Claims 10 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Inoue et al. (Figure 13) teach n- and p-electrodes on the same side of the light emitting element. In regard to the refractive index of sapphire, Admitted Prior Art Figures 1-2 and 5 teach a superstrate having a 1.84 refractive index and Inoue et al. teach a sapphire substrate having a 1.77 refractive index (col. 1, lines 11-15). Therefore, Admitted Prior Art Figures 1-2 and 5 teach a superstrate, having a refractive index greater than the refractive index of sapphire, attached to the heterostructure. Inoue et al. (Figure 13) teach a portion of the p-electrode 5 interposing portions of the n-electrodes 6 & 8. Admitted Prior Art Figure 2 teaches a conductive interface (buffer) disposed between an interconnect (pad) and an electrode.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respects to light emitting devices:

Kano (US 6,388,275 B1)

Kimura et al. (5,963,787)

Tanaka et al. (5,909,036).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M Soward whose telephone number is 703-305-3308. The examiner can normally be reached on Monday - Thursday, 6:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Ims

August 26, 2003


AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
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